

What is claimed is:

1. A method for operating a plasma enhanced chemical vapor deposition (PECVD) system, the method comprising:

performing a chamber seasoning process, wherein the chamber seasoning process comprises a chamber cleaning process, or a chamber pre-coating process, or a combination thereof, wherein the chamber cleaning process, when employed, uses a fluorine-containing gas, an oxygen-containing gas, or an inert gas, or a combination of two or more thereof, and wherein the chamber pre-coating process, when employed, uses a silicon-containing precursor, a carbon containing precursor, or an inert gas, or a combination of two or more thereof;

positioning a substrate on a substrate holder in the processing chamber;

depositing a film on the substrate, wherein a processing gas comprising a precursor is provided to the processing chamber during the deposition process; and

removing the substrate from the processing chamber.

2. The method as claimed in claim 1, further comprising:

positioning a new substrate on the substrate holder in the processing chamber;

depositing a film on the new substrate, wherein a processing gas comprising a precursor is provided to the processing chamber during the deposition process; and

removing the new substrate from the processing chamber.

3. The method as claimed in claim 2, further comprising:

performing a post-process chamber cleaning process, wherein the post-process chamber cleaning process uses a fluorine-containing gas, an oxygen-containing gas, or an inert gas, or a combination of two or more thereof.

4. The method as claimed in claim 3, wherein the post-process chamber cleaning process uses the fluorine-containing gas which comprises NF_3 , CF_4 , C_2F_6 , C_3F_8 , C_4F_8 , SF_6 , CHF_3 , F_2 , or COF_2 , or a combination of two or more thereof.

5. The method as claimed in claim 3, wherein the post-process chamber cleaning process uses the oxygen-containing gas which comprises H_2O , NO , N_2O , O_2 , O_3 , CO , or CO_2 , or a combination of two or more thereof.

6. The method as claimed in claim 3, wherein the post-process chamber cleaning process uses the inert gas which comprises Ar, He, or N_2 , or a combination of two or more thereof.

7. The method as claimed in claim 3, further comprising:
positioning a dummy substrate on the substrate holder before performing the post-process chamber cleaning process; and
removing the dummy substrate after performing the post-process chamber cleaning process.

8. The method as claimed in claim 2, wherein the film on the substrate comprises a Tunable Etch Resistant ARC (TERA) material, and the film on the new substrate comprises substantially the same TERA material.

9. The method as claimed in claim 1, wherein the film on the substrate comprises a Tunable Etch Resistant ARC (TERA) material.

10. The method as claimed in claim 1, further comprising:
positioning a dummy substrate on the substrate holder before performing the chamber seasoning process; and
removing the dummy substrate after performing the chamber seasoning process.

11. The method as claimed in claim 1, wherein the chamber seasoning process includes the chamber cleaning process and the chamber cleaning

process employs the fluorine-containing gas comprising NF_3 , CF_4 , C_2F_6 , C_3F_8 , C_4F_8 , SF_6 , CHF_3 , F_2 , or COF_2 , or a combination of two or more thereof.

12. The method as claimed in claim 1, wherein the chamber seasoning process includes the chamber cleaning process and the chamber cleaning process employs the oxygen-containing gas comprising H_2O , NO , N_2O , O_2 , O_3 , CO , or CO_2 , or a combination of two or more thereof.

13. The method as claimed in claim 1, wherein the chamber seasoning process includes the chamber pre-coating process and the chamber pre-coating process employs the silicon-containing precursor comprising monosilane (SiH_4), tetraethylorthosilicate (TEOS), monomethylsilane (1MS), dimethylsilane (2MS), trimethylsilane (3MS), tetramethylsilane (4MS), octamethylcyclotetrasiloxane (OMCTS), tetramethylcyclotetrasilane (TMCTS), or dimethyldimethoxysilane (DMDMOS), or a combination of two or more thereof.

14. The method as claimed in claim 1, wherein the chamber seasoning process includes the chamber pre-coating process and the chamber pre-coating process employs the carbon-containing gas comprising CH_4 , C_2H_6 , C_2H_4 , C_2H_2 , C_6H_6 , or $\text{C}_6\text{H}_5\text{OH}$, or a combination of two or more thereof.

15. The method as claimed in claim 1, wherein the chamber seasoning process includes the chamber cleaning process and the chamber cleaning process employs the inert gas comprising Ar, He, or N_2 , or a combination of two or more thereof.

16. The method as claimed in claim 1, wherein the chamber seasoning process includes the chamber pre-coating process and the chamber pre-coating process employs the inert gas comprising Ar, He, or N_2 , or a combination of two or more thereof.

17. The method as claimed in claim 1, wherein the PECVD system comprises an RF source and the chamber seasoning process includes the chamber cleaning process which further comprises:

operating the RF source in a frequency range from approximately 0.1 MHz. to approximately 200 MHz; and

operating the RF source in a power range from approximately 0 watts to approximately 10000 watts.

18. The method as claimed in claim 1, wherein the PECVD system comprises an RF source and the chamber seasoning process includes the chamber pre-coating process which further comprises:

operating the RF source in a frequency range from approximately 0.1 MHz. to approximately 200 MHz; and

operating the RF source in a power range from approximately 0.1 watts to approximately 10000 watts.

19. The method as claimed in claim 1, wherein the PECVD system comprises an upper electrode and a translatable substrate holder and the chamber seasoning process includes the chamber cleaning process which further comprises:

establishing a first gap between the upper electrode and the translatable substrate holder during a first time; and

establishing a second gap between the upper electrode and the translatable substrate holder during a second time.

19. The method as claimed in claim 18, wherein the first gap is less than or equal to the second gap.

20. The method as claimed in claim 18, wherein the second gap is less than or equal to the first gap.

21. The method as claimed in claim 1, wherein the PECVD system comprises a temperature control system coupled to a substrate holder and the chamber seasoning process includes the chamber cleaning process which

further comprises controlling the substrate holder temperature between approximately 0° C. and approximately 500° C.

22. The method as claimed in claim 1, wherein the PECVD system comprises a temperature control system coupled to a substrate holder and the chamber seasoning process includes the chamber pre-coating process which further comprises controlling the substrate holder temperature between approximately 0° C. and approximately 500° C.

23. The method as claimed in claim 1, wherein the PECVD system comprises a pressure control system coupled to the chamber and the chamber seasoning process includes the chamber cleaning process which further comprises controlling the chamber pressure between approximately 0.1 mTorr and approximately 100 Torr.

24. The method as claimed in claim 1, wherein the PECVD system comprises a pressure control system coupled to the chamber and the chamber seasoning process includes the chamber pre-coating process which further comprises controlling the chamber pressure between approximately 0.1 mTorr and approximately 100 Torr.

25. The method as claimed in claim 1, wherein the PECVD system comprises a temperature control system coupled to a chamber wall and the chamber seasoning process includes the chamber cleaning process which further comprises controlling the chamber wall temperature between approximately 0° C. and approximately 500° C.

26. The method as claimed in claim 1, wherein the PECVD system comprises a temperature control system coupled to a shower plate assembly and the chamber seasoning process includes the chamber cleaning process which further comprises controlling the shower plate assembly temperature between approximately 0° C. and approximately 500° C.

27. The method as claimed in claim 1, wherein the film comprises a material having a refractive index (n) ranging from approximately 1.5 to approximately 2.5 when measured at a wavelength of at least one of: 248 nm, 193 nm, and 157 nm, and an extinction coefficient (k) ranging from approximately 0.1 to approximately 0.9 when measured at a wavelength of at least one of: 248 nm, 193 nm, and 157 nm.

28. A plasma enhanced chemical vapor deposition (PECVD) system comprising:

a plasma processing chamber;

a substrate holder configured within the plasma processing chamber;

and

means for performing a chamber seasoning process, wherein the chamber seasoning process comprises a chamber cleaning process, or a chamber pre-coating process, or a combination thereof, wherein the chamber cleaning process, when employed, uses a fluorine-containing gas, an oxygen-containing gas, or an inert gas, or a combination of two or more thereof, and wherein the chamber pre-coating process, when employed, uses a silicon-containing precursor, a carbon containing precursor, or an inert gas, or a combination of two or more thereof.

29. The system as claimed in claim 28, further comprising:

means for positioning a new substrate on the substrate holder in the plasma processing chamber;

means for depositing a film on the new substrate, wherein a processing gas comprising a precursor is provided to the processing chamber during the deposition process; and

means for removing the new substrate from the plasma processing chamber.

30. The system as claimed in claim 28, further comprising:

means for performing a post-process chamber cleaning process, wherein the post-process chamber cleaning process uses a fluorine-

containing gas, an oxygen-containing gas, or an inert gas, or a combination of two or more thereof.

31. The system as claimed in claim 30, further comprising:

means for placing a dummy substrate on the substrate holder in the plasma processing chamber;

means for performing post process chamber cleaning process, wherein the post process chamber cleaning process uses a fluorine-containing gas, an oxygen-containing gas, or an inert gas, or a combination of two or more thereof; and

means for removing the dummy substrate from the substrate holder after post process chamber cleaning process.

32. The system as claimed in claim 28, wherein the film comprises a Tunable Etch Resistant ARC (TERA) material.

33. The system as claimed in claim 28, further comprising:

means for placing a dummy substrate on the substrate holder in the plasma processing chamber;

and

means for removing the dummy substrate from the substrate holder after chamber seasoning process.